Fishery Management Report No. 03-02

Fishery Management Plan for Arctic Grayling in the Delta Clearwater River, 2001–2004

by

James F. Parker

February 2003

Alaska Department of Fish and Game **Division of Sport Fish**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used in Division of Sport Fish Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications without definition.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
metric ton	mt
milliliter	ml
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.
All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.
and	&
at	@
Compass directions:	
east	E
north	N
south	S
west	W
Copyright	©
Corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
et alii (and other people)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.,
id est (that is)	i.e.,
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
number (before a number)	# (e.g., #10)
pounds (after a number)	# (e.g., 10#)
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)

Mathematics, statistics, fisheries

alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	F, t, χ^2, etc.
confidence interval	C.I.
correlation coefficient	R (multiple)
correlation coefficient	r (simple)
covariance	cov
degree (angular or temperature)	°
degrees of freedom	df
divided by	÷ or / (in equations)
equals	=
expected value	E
fork length	FL
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
mideye-to-fork	MEF
minute (angular)	'
multiplied by	x
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
standard length	SL
total length	TL
variance	Var

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The Fishery Management Reports series was established in 1989 for the publication of an overview of Division of Sport Fish management activities and goals in a specific geographic area. Fishery Management Reports are intended for fishery and other technical professionals, as well as lay persons. Fishery Management Reports are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm This publication has undergone regional peer review.

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PREFACE

The Alaska Department of Fish and Game (ADF&G) is the fish and wildlife management agency for the State of Alaska. The Division of Sport Fish is the management division within ADF&G that is responsible for the management of sport fisheries. The goals of Sport Fish Division are to conserve wild stocks of sport fish, to provide diversity of recreational fishing opportunities for the public, and to optimize the social and economic benefits from recreational fisheries for all Alaskans. To accomplish these goals the Division of Sport Fish has instituted a fisheries management process that relies on sound scientific principles and public involvement. Part of this process is the development of Sport Fish Management Plans for sport fisheries that are important to the public or that have characteristics that require focused management.

The Sport Fish Management Plan for Arctic grayling in the Delta Clearwater was a result of the public process, which included the regulatory prescription handed down by the Alaska Board of Fisheries. The open regulatory process of the Board of Fisheries enabled numerous opportunities for public participation in the development of regulations relating to this plan. The objectives found in this plan were developed around the implied intent of the regulatory process and the best available scientific information. The objectives should be viewed as dynamic and therefore should continue being the focus of discussions between managers, the public, and the Board of Fisheries.

INTRODUCTION

DELTA CLEARWATER RIVER DESCRIPTION

The Delta Clearwater River (DCR) is the largest of several spring-fed tributaries of the Tanana River and supports a sport fishery directed on Arctic grayling *Thymallus arcticus*. The Arctic grayling fishery is composed primarily of spawning size fish (>12 inches TL) that move into the DCR, after spawning, from at least eight different systems. The DCR provides quality summer feeding habitat, but Arctic grayling do not spawn or overwinter there. The DCR is known for its high catch rates, presence of large Arctic grayling, and pristine water quality.

FISHERY BACKGROUND

The fishery was managed as a consumptive fishery in the early 1990s and then a non retention fishery. As fishing pressure increased the population structure changed from many smaller-sized fish to fewer larger-sized fish in the system. Restrictive regulations starting in 1994 were instrumental in limiting opportunity. The presence of fewer but larger fish is perceived to have caused a change in the angler constituency using the DCR. Anglers primarily use fly-fishing gear to pursue grayling at known riffle areas during fly hatches. Anglers now enjoy a fishing quality unequal to most grayling waters in the state, as most fish caught are over 14 inches in length. Resident anglers come from all areas of the state to fish these waters. This is evident from testimony by fishing organizations prior to and during the BOF meetings in January 2001. Local anglers also have an interest in the quality of the fishery. Most of the effort for Arctic grayling occurs from the first of June thru September.

HISTORICAL PERSPECTIVE

Irene Mead of the Delta Historical Society dates sport fishing on the DCR to 1939. Her parents, Bert and Mary Hanson, took hunting and fishing parties to Clearwater Creek and Lake from

across the ferry crossing at Rika's Roadhouse or McCarty (location name). Bert Hanson bought a roadhouse near the mouth of the Clearwater Creek known as the Smith and Maxfield Roadhouse. This building was used during the Chisana Gold rush in 1913 and still exists. A bridge crossed the creek near the roadhouse at that time. Bert guided his hunting and fishing parties from this cabin and operated an extensive trap line as well. Bert's clients came mainly from Fairbanks, many of them eventually developing homesteads along the Creek. In 1950 Bert considered the creek fished out while also indicating that poor fishing existed on the Goodpaster River as well. Access from the Alaskan Highway to the Clearwater Creek came in 1950 when Al Remington built the Clearwater Ranch upstream of the present Clearwater Park and campground.

DELTA CLEARWATER RIVER LAND USE

The Delta Clearwater River (DCR) is a 34-km spring-fed system located 177 km southeast of Fairbanks and 23 km northeast of Delta Junction in the middle Tanana River drainage (Figure 1). The Department of Natural Resources (DNR) manages the Delta Clearwater River to maintain and enhance the water quality, fish and wildlife habitat, and recreational resources (DNR 1991). In the DNR Tanana Basin Area Plan the Delta Clearwater River corridor, its headwaters, and surrounding wetlands were recommended for legislative designation as a state Recreation River (DNR 1991). This recommendation included both the Delta Clearwater River and Clearwater Lake. Clearwater Lake and the Delta Clearwater River are in a region of upwelling water from the alluvial fan of the Delta and Gerstle rivers. This water makes these areas some of the few waterbodies in interior Alaska that remain ice-free year-round. The Delta Clearwater River is closed to mineral sales, further land disposals, and remote cabins. State Parks (DNR) operates a campground and the only public boat launch at mile 8 on the Delta Clearwater River. Another access site is from Clearwater Lake. Upon exiting Clearwater Lake outlet, one can boat one mile upstream in a slough of the Tanana River to the mouth of the Delta Clearwater River. There are a number of private parcels on the Delta Clearwater River, most of which are located between miles 4 and 9.

FISHERY PERFORMANCE

Prior to 1987, estimated average annual effort in the DCR was over 6,500 angler days. At that time about 87% of the angler days were directed toward Arctic grayling and the average harvest was 5,700 fish. New regulations adopted in 1987 included no retention of Arctic grayling from 1 April to the first Saturday in June, a 12-inch minimum size limit, a bait restriction, and 5 fish daily bag and possession limit.

From 1981 thru 1988, large Arctic grayling stocking contributions may have been influential in generating high harvest rates averaging nearly 40% of the population. The numbers of Arctic grayling began a downward trend after 1988. The estimated abundance in 1996 was less than 3,000 fish that were age-5 and older (~12 inches in length). In 1995 and 1996, the bag and possession limit was reduced to two fish by emergency order (Appendix A).

These emergency orders reduced the exploitation rate down to 25% of the assessed population.

Abundance in 1997 increased to 4,600 fish that were age-5 and older. Estimated abundance of Arctic grayling during the same year (1997) for fish greater than 270 mm FL (~12 in) was 6,490, demonstrating a strong influx of smaller fish (Appendix B1). The 2000 estimate of abundance for age-5 Arctic grayling was 6,891 and those $\geq$ 270 mm FL was 7,634 (Gryska 2001). From 1997 to 2000 large numbers of older fish recruited into the population.

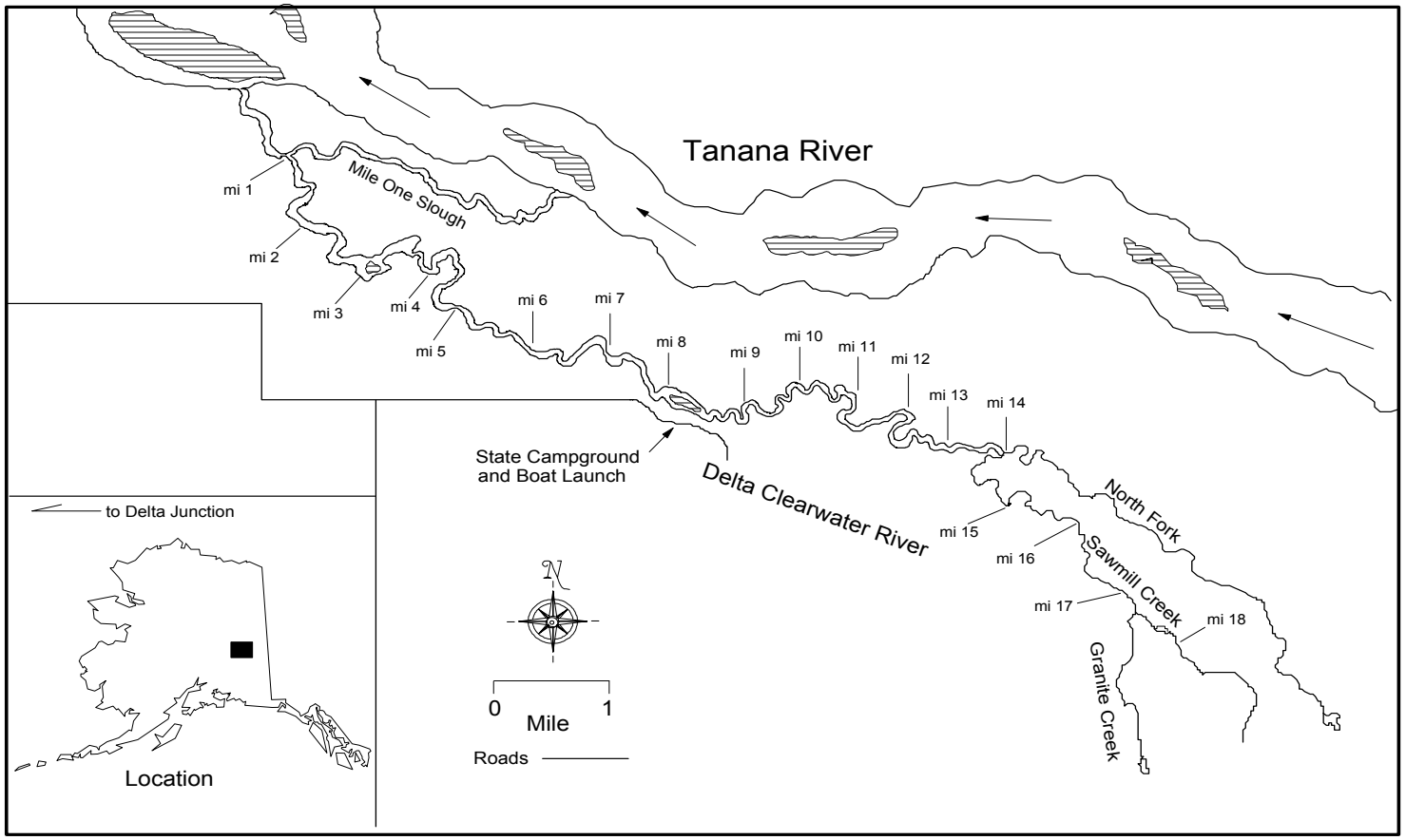

Figure 1.-Map of the Delta Clearwater River

During the summer of 1997, an emergency order was issued restricting the fishery to catch-and-release only. In 1997, the Board of Fish (BOF) made permanent the catch-and-release regulation for grayling in the DCR. Since then, the numbers and size at age of Arctic grayling has increased. The opportunity to catch large Arctic grayling has likely resulted in an increase in angler days from 1,650 (1997) to 4,300 in 1999. The catch rates (1997-1999) have averaged nearly four fish per angler day.

During 2000, a total of 17 proposals were submitted to the BOF to allow some harvest of Arctic grayling in the DCR. Biologically, a harvest can be sustained at a 15% exploitation rate, or currently about 900 fish annually. There is broad consensus from the angling public for the department to maintain large fish in the population. It was believed these characteristics can be maintained, provided that harvest is not directed on the large fish. It was recommended by department staff that if harvest were allowed, it should only be prosecuted on fish less than 12 inches. The BOF in January 2001 adopted the following regulations, to allow a harvest and help maintain large fish in the DCR:

1. a one fish daily bag and possession limit;
2. the open season for Arctic grayling is July 10-August 9; catch-and-release only from August 10 to July 9;
3. the maximum size limit of Arctic grayling is 12 inches (TL) or less; and,
4. only un-baited, single hook, artificial lures may be used from January 1 to August 31; and only un-baited, artificial lures may be used from September 1 to December 31).

MANAGEMENT OBJECTIVES AND RATIONALE

Following the intention of these regulations, the management objectives for the Delta Clearwater River Arctic grayling recreational fishery are:

1. **To maintain a fishery in which at least 40% of the assessed population of Arctic grayling exceeds 14 inches in length.**

Seasonal migrations of the Delta Clearwater River Arctic grayling population must be considered when evaluating both management policies and plans. For this population, extensive spring and fall migrations occur relative to spawning, summer feeding and overwintering. Therefore only a small portion of the population in the DCR is typically less than 12-14 inches because all grayling there migrate from somewhere else. The measurable population is generally viewed as fish over five years of age or fish of a certain size (e.g. 270 mm FL). In 1999, 48% of the measured population was 14 inches (TL) or greater, increasing to 54% in 2000. Based upon the size composition measured within recent years and the public desire to maintain the presence of large fish, it is reasonable to assume that the department can manage this fishery such that 40% of the measurable population will be of fish greater than 14 inches. Regulations enacted by the BOF in 2001 were developed to maintain large fish within the population while allowing a small harvest of fish less than 12 inches. The success of meeting this objective is not based upon increasing the number of fish but in maintaining the numbers of large fish characteristic of the population. It should be noted that these existing regulations were not a result or a conservation concern but were adopted to maintain a quality in the fishery desired by anglers. There was no conservation concern after the population went from below 2,500 fish in 1996 to the current level of about 7,000 in 2000 (Appendix B1).

2. **To allow a harvest not to exceed 900 fish less than 12 inches in length.**

In addition to maintaining large fish in the DCR, new BOF regulations were designed to allow a small harvest of fish less than 12 inches. Simulations show that a harvest of 900 fish or fewer is sustainable in the DCR. Simulations also indicated that the current length structure would only be affected minimally, by a harvest of fewer than 900 fish that are less than 12 inches. The number of fish harvested in the DCR is estimated from data collected from a statewide survey sent to a portion of anglers who purchased a fishing license, asking them where and what fish they caught and harvested the proceeding season. In 2001, new BOF regulations allow for a harvest of one fish per day, less than 12 inches TL in size, from July 10 to August 9. The timing of the open season avoids potentially high harvests during the July 4 weekend.

3. **To prosecute the fishery in such a way as to provide for a minimum catch rate of one Arctic grayling per angler day.**

Data to determine angler days of effort, harvest, and catches come from the Statewide Harvest Survey (SWHS). A mail out survey targeting Arctic grayling fishers found that about 75% of the DCR angler-days are directed on Arctic grayling. Angler-days on Arctic grayling increased from 1,642 in 1997 to 4,336 in 1999. With current management, angler-days will likely continue to increase despite aberrations such as in 2000 (Appendix B2). In 1998, effort was 2,600 angler days with a catch rate of 6.2 per day. The catch rate declined to 2.7 in 1999 when angler-days nearly doubled to 4,300. The lowest recent catch rate data for Arctic grayling in the DCR was 1.26 fish per angler day in 1995. If the catch rate were to fall below 1.0, which almost occurred in 1996, then the department would be alerted to a possible conservation concern.

EVALUATION AND RESEARCH RECOMMENDATIONS

The Artic grayling population in the DCR will be deemed healthy if all three objectives are being met. To evaluate objectives and ensure that regulations don't need to be changed, length and age composition of the measurable population should be estimated every three to five years (2003) using established sampling methods. The number of fish harvested and catch rate will be measured every year (1-year lag). When any one of the objectives are not met, the department will determine a course of action to evaluate the true health of the stock and to determine if there is a need to propose a change in regulation based on the BOF regulatory cycle.

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APPENDIX A

Appendix A.-History of Arctic grayling sport fish regulations for the Delta Clearwater River.

1962

Initial regulations after Statehood

- Entire Tanana Drainage – Daily bag limit is 10 per day 10 in possession no more than two fish may be over 20-inches.

1977

Bag, possession, and size limit

- Entire Tanana Drainage – Daily bag limit is 5 per day 10 in possession no more than two fish daily or four in possession may be over 20-inches.

1985

Size limit

- No size limit.

1987/88

The Board of Fisheries did not meet in the winter of 1986. Sweeping changes to regulations in the Tanana River drainage were not addressed. Emergency orders were made in 1987 and became permanent regulations in 1988. The following (new) regulations are as such:

BAG, POSSESSION, SEASON, SIZE LIMIT, SPECIAL REGULATION

DELTA CLEARWATER RIVER

- Bag limit for grayling is 5 per day, 5 in possession
- Open season for grayling is First Saturday in June through March 31.
- 12-inch minimum size limit.
- Only unbaited, artificial lures or flies may be used.
- Grayling caught April 1 to the first Saturday in June must be released immediately.

1995

SEASONS

Delta Clearwater River

- April 1 through May 31, Arctic grayling catch-and-release only.
- June 1 through March 31, Arctic grayling Daily Bag and possession limit is 5 fish; all must be 12 inches or larger.

1996-1997

BAG LIMIT

Delta Clearwater River

- Daily bag and possession limit (by emergency order) is 2 fish over 12 inches.

-continued-

1997&1998

BAG LIMIT

Delta Clearwater River and Clearwater Lake

- Catch-and-release only for the entire year.
- Only unbaited, single hook, artificial lures may be used from January 1 to August 31.
- Only unbaited, artificial lures may be used from September 1 to December 31.

2001- PRESENT

The BOF passed the following regulations for the DCR becoming effective in March 2001. The following regulatory change in Bag, size, and season for Arctic grayling are:

Delta Clearwater River and Clearwater Lake.

- The Daily Bag and possession limit is 1 per day.
- The maximum size limit is 12-inches, all fish greater than 12 inches must be released.
- The open season for Arctic grayling fishing is July 10-August 9
- August 10 – July 9, catch-and-release only for Arctic Grayling.

Continue the following existing regulations.

- Unbaited, single hook, artificial lures may be used from January 1 to August 31.
- Only unbaited, artificial lures may be used from September 1 to December 31.

APPENDIX B

Appendix B1.- Summary of Arctic grayling estimates and standard errors within the Delta Clearwater River, 1977-2000[a].

Year	N[150]	SE[N150]	N[240]	SE[N240]	N[270]	SE[N270]	N[Age 5+][a]	SE[Age 5+]	Recruitment N[Age 5][a]	Recruitment SE[Age 5]
1977	Nd	---	nd	---	Nd	---	9,702	1,234	5,862	1,335
1978	Nd	---	nd	---	Nd	---	8,826	1,279	4,461	1,484
1979	Nd	---	nd	---	Nd	---	6,258	885	4,134	1,146
1980	Nd	---	nd	---	nd	---	6,175	832	3,467	856
1981	Nd	---	nd	---	nd	---	9,829	1,461	6,907	1,640
1982	Nd	---	nd	---	nd	---	9,369	1,159	4,554	1,173
1983	Nd	---	nd	---	nd	---	12,760	1,746	7,828	1,999
1984	Nd	---	nd	---	nd	---	11,063	1,276	4,931	1,295
1985	Nd	---	nd	---	nd	---	10,767	1,388	4,458	1,267
1986	Nd	---	nd	---	nd	---	7,840	1,148	2,724	708
1987	Nd	---	nd	---	nd	---	7,684	1,289	3,571	933
1988	Nd	---	nd	---	nd	---	8,845	1,962	1,957	578
1989	Nd	---	nd	---	nd	---	6,482	1,751	2,420	601
1990	Nd	---	nd	---	nd	---	4,477	1,766	2,301	619
1991	Nd	---	nd	---	nd	---	nd	---	1,754	686
1992	Nd	---	nd	---	nd	---	nd	---	2,219	1,066
1993	Nd	---	nd	---	nd	---	nd	---	945	692
1994	Nd	---	nd	---	nd	---	nd	---	1,179	1,491
1995	Nd	---	nd	---	nd	---	nd	---	Nd	---
1996	Nd	---	3,000	370	2,750	340	2,490	310	670	100
1997	9,000	920	7,420	920	6,490	800	4,600	590	810	140
1998	nd	---	5,570	780	4,740	480	4,500	630	1,820	300
1999	nd	---	6,977	401	6,684	211.3	6,271	369	1,760	140
2000	nd	---	8,045	946	7,634	900	6,891	821	1,748	255
Average	N/A	---	6,203	---	5,660	---	7,622	---	3,153	---

[a] Estimates for 1977 - 1990 are from CAGEAN modeling (Clark and Ridder 1994) and reflect population at start of fishing season. Estimates for 1996 - 1999 are from mark-recapture experiments and reflect the population in July (Ridder 1998b; 1999a; Ridder and Gryska 2000; and Gryska 2001).

Nd = no data

N/A = non applicable

Appendix B2.-Recreational fishing effort, harvest and catch of Arctic grayling, coho salmon, chum salmon and whitefish in the Delta Clearwater River from the Statewide Harvest Survey, 1977-2000[a].

Year	Angler Days	Grayling Angler Days	Harvest Grayling <12"	Harvest Grayling >12"	Total Harvest Grayling	Harvest Coho	Harvest Chum Salmon	Harvest WF	Catch of Grayling <12"	Catch of Grayling >12"	Total Catch Grayling	Catch Coho	Catch Chum Salmon	Catch WF
1977	6,881	6,798	...	...	6,118	31	19	28	...	...	...	...	...	...
1978	7,210	6,873	...	...	7,657	126	59	0	...	...	...	...	...	...
1979	8,398	8,398	...	...	6,492	0	0	53	...	...	...	...	...	...
1980	4,240	4,173	...	...	5,680	25	25	29	...	...	...	...	...	...
1981	4,673	4,553	...	...	7,362	45	0	203	...	...	...	...	...	...
1982	4,231	4,175	...	...	4,779	21	21	94	...	...	...	...	...	...
1983	5,867	5,698	...	...	6,546	63	63	262	...	...	...	...	...	...
1984	5,139	3,611	...	...	4,193	571	182	325	...	...	...	...	...	...
1985	8,722	6,790	...	...	5,809	722	174	1,015	...	...	...	...	...	...
1986	10,137	2,867	...	...	2,343	1,005	246	208	...	...	...	...	...	...
1987	5,397	3,123	...	...	2,005	1,068	42	66	...	...	...	...	...	...
1988	5,184	3,092	...	...	2,910	1,291	0	1,114	...	...	...	...	...	...
1989	5,368	2,500	...	...	3,016	1,049	29	34	...	...	...	...	...	...
1990	4,853	2,263	...	...	1,772	1,375	0	0	...	...	12,424	3,271	55	0
1991	5,594	2,605	0	2,165	2,165	1,721	98	91	3,033	4,965	7,998	4,382	98	376
1992	3,756	1,765	0	797	797	615	68	294	2,669	3,417	6,086	1,555	289	358
1993	4,909	2,307	0	437	437	48	0	0	3,074	2,638	5,712	1,695	101	50
1994	3,984	3,028	375	1,036	1,411	509	0	10	4,269	5,037	9,306	3,009	66	38
1995	6,261	4,758	0	926	926	463	72	0	1,620	4,354	5,974	5,195	441	9
1996	3,424	2,602	0	1,218	1,218	937	0	0	3,354	5,624	8,978	2,435	110	65
1997	2,161	1,642	0	0	0	794	0	0	2,980	1,685	4,665	4,174	57	85
1998	3,415	2,595	0	0	0	479	0	0	4,842	11,293	16,135	2,350	0	77
1999	5,705	4,336	0	0	0	75	0	14	2,444	9,328	11,772	1,634	203	145
2000	2,647	2,012	0	0	0	255	12	36	2,339	6,351	8,690	1,911	12	43
Means														
1977-2000	5,340	3,857	38	658	3,068	752	57	40	3,062	5,469	8,885	2,874	130	113
1996-2000	3,470	2,638	0	244	244	508	2	10	3,192	6,856	10,048	2,501	76	83

[a] Mills 1979-1994; Howe et al. 1995, 1996, 2001a, b, c, d; Walker et al. *In prep.*